PROGRAM REQUIREMENTS

Overview

The Biochemistry and Molecular Biophysics graduate program is designed to prepare students for careers as independent investigators and educators in the area of modern biochemistry and molecular biophysics. The curriculum has been designed to provide a superior graduate level education by tailoring the curriculum to each individual student in order to round out the student’s knowledge of biochemistry and molecular biophysics, while building on the strengths of the student and equipping the student for dissertation research. In addition to formal lecture courses, research seminars and informal interactions with other graduate students, post-doctoral fellows and faculty members form an important part of graduate education. The ability to make oral scientific presentations is an essential part of a scientific training, and is a required part of the program.

General Requirements

- BMB 699 (Laboratory Rotation) – rotations in 3 different labs
- BIOM 600 (Cell Biology) – required (fall, first year)
- BMB 508 (Macromolecular Biophysics I) – required (fall, first year)
- BMB 509 (Macromolecular Biophysics II) - required (spring, first year)
- BMB 705 (Candidacy Exam Prep Course) – required (spring, second year)
- Six additional elective credits are required that may include formal lecture courses and seminars.

Combined Degree Programs

Students in the MD/PhD program typically follow these guidelines for the Ph.D. portion of their coursework.

| Year 1 Medical School (spring) | One graduate course |
| Year 1 Medical School (summer) | One laboratory rotation |
| Year 2 Medical School (fall)   | One graduate course or laboratory rotation |
| Year 3 (fall & spring)        | Full time graduate program and Candidacy Exam |
| Years 4 - 6                   | Full time dissertation |

Eleven to fourteen credits may be transferred from the School of Medicine to complete the 6 elective credits that are required.

Students in the VMD/PhD program generally follow the same guidelines as those in the MD/PhD program, although the full time graduate program for these students usually begins in the spring of Year 3.
Combined degree students are usually exempt from Lab Rotation 3. Students are advised by the Advising Committee of the BMB Graduate Group.

Contact the MD/PhD Program: [http://www.med.upenn.edu/mstp/](http://www.med.upenn.edu/mstp/)

Contact the VMD/PhD Program: [http://research.vet.upenn.edu/Default.aspx?alias=research.vet.upenn.edu/pennvetphd](http://research.vet.upenn.edu/Default.aspx?alias=research.vet.upenn.edu/pennvetphd)

**BMB Courses**

**One-semester courses** (1 credit each)

- **BMB 508** Macromolecular Biophysics: Principles and Methods
- **BMB 509** Structural and Mechanistic Biochemistry
- **BMB 518** Protein Conformation Diseases
- **BMB 560** Methods of Scientific Inquiry in Biological Systems
- **BMB 567** Bioinorganic Chemistry
- **BMB 581** Techniques of Magnetic Resonance Imaging
- **BMB 585** Wistar Institute Cancer Biology Course: Cell Cycle Checkpoints and Cancer
- **BMB 590** Biological Physics
- **BMB 616** Medical Problems in Modern Biochemistry
- **BMB 633** Cellular Biochemistry and Biophysics
- **BMB 650** Current Biochemical Topics – Raiziss Rounds
- **BMB 700** Selected Topics in Chemistry

**Mini-courses** (1/2 semester; 1/2 credit each)

- **BMB 601** Fundamentals of Magnetic Resonance
- **BMB 602** Imaging (to be first offered in Spring 2014)
- **BMB 611** Advanced X-ray Diffraction Methods
- **BMB 618** Applications of High Resolution NMR Spectroscopy to Problems in Structural Biology
- **BMB 619** Protein Folding
- **BMB 622** Physical Principles of Mechano-Enzymes
- **BMB 624** Ion Channels and Pumps
- **BMB 626** Mass Spectrometry and Proteomics
- **BMB 627** Computing Programming for Biophysicists and Biochemists
- **BMB 628** Principles of Scientific Instrumentation
- **BMB 629** Quantitative Problems in Biochemistry and Biophysics
- **BMB 632** Probing Structure and Function of Complex RNA-Protein Machines
- **BMB 705** Candidacy Exam Prep Course (1/2 credit)

**Lab Rotation/Independent Studies**

- **BMB 699** Lab Rotation (1 credit)
- **BMB 799** Independent Study (YRS 1 – 2) (may be taken for 1/2 to 4 credits)
- **BMB 999** Independent Study (YRS 3 – 5) (may be taken for 1/2 to 4 credits)
It is expected that in the first year, courses of a more general and foundational nature will be taken in order to give students a well-rounded and diverse background in the biochemical sciences. Subsequent lecture or seminar courses are designed to increase the student’s background in more specialized areas. The three laboratory rotations ensure that first year students quickly become familiar with the variety of research opportunities available within the graduate program and so can choose a suitable Thesis Advisor. Full-time thesis research generally begins at the end of the second year, and students are encouraged to develop rigorous and creative approaches to examine significant problems in biology.

Many of the courses available to BMB students are taught in collaboration with other graduate programs or departments. Topics covered by these courses include molecular genetics of prokaryotes and eukaryotes, the structure and function of proteins and nucleic acids, molecular cell biology, biophysics of macromolecules, regulation of cell growth, membrane structure and function, virology, gene therapy, x-ray diffraction, and spectroscopy. A listing of all courses offered at the University is described in the University’s Course Register or online at http://www.upenn.edu/registrar.

Lab Rotation (BMB 699)

1. The purpose of the Lab Rotation is to provide the student with the opportunity to experience different laboratory environments and different experimental approaches and in so doing, assist him or her in choosing a laboratory for thesis work.

2. A student is required to do a rotation in three different laboratories. The rotations must be with a member of the Graduate Group. The Chair of the Graduate Group must approve, in writing, any exemptions from the three required lab rotations.

3. In general, all rotations are to be completed by the end of the first year, enabling the student to select a research lab by the beginning of the second year. If needed, a fourth rotation may be taken in the second half of the summer after the first year.

Time schedule for rotations:

Rotation 1: Fall semester.
Rotation 2: Spring semester
Rotation 3: Summer I session
Rotation 4: Summer II session (if needed)

An incoming student may take Rotation 1 in the summer prior to the Fall semester. The date for the start of the Lab Rotation is different every year, but is usually the first or second week of June.

4. Students should begin to search for a Faculty Supervisor about one month before the beginning of the proposed rotation. An appointment to discuss possible projects should be arranged with the potential Faculty Supervisor. Students are encouraged to talk with
several faculty, and to discuss with the Course Director the choice of Faculty Supervisor and other options, prior to making a commitment to a specific laboratory.

5. The rotation is under the supervision and guidance of the Faculty Supervisor. At the beginning of a lab rotation, the Faculty Supervisor and student are encouraged to discuss and clearly define the goals of the project. A "Lab Rotation Approval Form" with project title must be signed by both the student and the Faculty Supervisor, approved by the Course Director, and returned to the Academic Office. The Course Director should be notified in case of difficulties or shortcomings that may jeopardize the expeditious and satisfactory progression of the proposal.

6. Upon completion of the rotation, the Faculty Supervisor must submit a grade and a written evaluation of the student's performance for inclusion in the student's file. A copy of this evaluation may be given to the student upon request. Students are encouraged to discuss the contents of the written evaluation with their Faculty Supervisor. The student will also be asked to provide a confidential evaluation of the lab rotation experience.

7. One week prior to the rotation talks (see below), a 150-word abstract should be submitted to the course director and the Academic Office. The abstract should describe the issue/question motivating the study, the approaches taken to address the issue/question, and a synopsis of key findings, conclusions and future directions. Failure to submit the abstract in a timely manner will affect the rotation grade. Please also give your abstract a title (which does not count toward the word limit).

8. At the end of each semester (fall, spring and summer), all students participating in rotations that semester will be scheduled to present a short talk (10 – 12 min talk, 3-5 min questions) on their work to the Graduate Group faculty and students (Lab Rotation Talks). The emphasis is not on the quality/quantity of the data acquired, but on (a) learning to give a talk (communicating) and (b) demonstrating how one has thought about one’s research project, including the overall aims, thrust and importance of the project. Students are welcome to choose whatever form(s) of visual aid they prefer, including overheads, slides and/or PowerPoint-type presentations. Given the ease and accessibility of PowerPoint, use of this medium is encouraged.

This is a requirement for completion of the course. The main purpose of the talk is to give the students at least three opportunities to present a prepared/practiced short talk in a relatively informal setting, and to provide them with helpful feedback pertaining both to the scientific content and to the student’s style and presentation skills. Anyone who fails to give a presentation at the scheduled time will obtain an incomplete for the course and will be scheduled to present on that rotation during the Lab Rotation Talks the following semester (giving two talks if also registered in the class for that semester). Under exceptional circumstances, and subject to approval by the Course Director and the Faculty Supervisor for the rotation, a paper may be accepted in lieu of the presentation. The Faculty Supervisor may also require a student to prepare a short report or paper at the completion of the rotation.
9. Attendance at the Lab Rotation Talks is required. Unexcused absence from all or part of the session will result in reduction of the grade submitted by the Faculty Supervisor by one half grade.

10. After completing the three rotations, students should be able to make an informed choice as to a Thesis Advisor. If a student is not able to find a suitable lab after three rotations, he or she can petition the Course Director for permission to do an additional rotation or independent study to find a Thesis Advisor.